[redacted]

BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

SUBJECT: Commentary - Use of LC-39 for the Launching of Saturn IB's in the Apollo Applications Program
Case 620

DATE: March 7, 1969

FROM: G. W. Craft

ABSTRACT

Basic launch facilities, not including AAP modifications for the five AAP flights in 1971-1972, are expected to cost $29 million at LC-34 and 37. An equivalent capability at LC-39, it has been estimated, would cost only $5-$10 million. But there are some questions related to: 1) the details and cost of the proposed method for adapting LC-39 facilities--interchangeably--to the launch of Saturn IB, 2) the impact on Saturn V launch schedules, 3) the method of providing service structure functions for a dual launch with only one MSS, and 4) subsequent uses for LC-34/37.

Factors bearing on these questions are discussed and it is concluded that:

- LC-39 is adaptable--with reasonable convertability--to the launch of Saturn IB; there seems to be no reason to doubt the $10 million estimate of costs.

- Launch-to-launch interval for Saturn V over the span of AAP flight activities (8 months) would be about ten months if AAP flew from LC-39.

- A single MSS would need help in servicing the AAP dual missions. The best method may be to provide some of the MSS functions for unmanned vehicles from the LUT.

- LC-34 and 37 use in subsequent programs may involve very large changes from their Saturn IB configurations.

(NASA-CR-106900) COMMENTARY - USE OF LC-39 FOR THE LAUNCHING OF SATURN IB'S IN THE APOLLO APPLICATIONS PROGRAM (Bellcomm, Inc.) 19 p
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955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

SUBJECT: Commentary - Use of LC-39 for the Launching of Saturn IB's in the Apollo Applications Program Case 620

DATE: March 7, 1969

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MEMORANDUM FOR FILE

[redacted]

INTRODUCTION

LC-34 and LC-37 at KSC have been or are being "mothballed" for storage until needed for the Apollo Applications Program's Saturn IB launches now slated to begin in late 1971.* Both complexes are needed to support the two AAP dual missions. The expected costs for down-mode maintenance of the two complexes for such items as painting, security, record keeping, and environmental control is about $3 million per year. Rehabilitation and updating which will have to start about a year before the first AAP missions will cost about $20 million. Total cost of basic launch facilities for the five planned AAP flights: $29 million.

Because of the high costs of retaining LC-34/37 for AAP, KSC last fall let a contract to Boeing to study the possibility of launching Saturn IB's from LC-39. This study, reported in the past month by M. M. Cutler,** produced an estimate of costs for modifications to enable one launch of one Saturn IB from LC-39 at $2.5 million.

For the dual AAP missions, Boeing first made the assumption that by careful scheduling, a single MSS could support day-apart launches. Total costs for modifying LC-39 for the AAP then came to $4.78 million excluding

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*LC-34 and LC-37 Deactivation - Case 620, Memorandum for File, November 29, 1968, A. W. Starkey.

**Trip Report - Use of LC-39 to Launch Saturn IB, Case 105-2, Memorandum for File, January 21, 1969, M. M. Cutler special modifications for the AAP spacecraft modifications which would also have to be done at LC-34 and LC-37 at a cost additive to the $29 million mentioned above.* On the other hand, if sharing the MSS between two launch pads proved impractical, Boeing calculated that the MSS functions for the unmanned AAP payloads could be provided by adding special arms and corollary MSS services to one of the LUTs. The additional costs, it was estimated, would bring the basic LC-39 cost for AAP to $9.5 million.

Fundamental to Boeing's proposal for modifying LC-39 for a Saturn IB capability is an elevated pedestal which is used to raise the S-IB stage about 127 feet above the S-IC pedestal. This would make it possible to maintain most of the existing umbilical and servicing platform interfaces for the S-IVB and spacecraft.

Down time for implementation of the Saturn IB modifications would be 120 days for a LUT, 13 for a VAB high bay, 12 for the MSS and 46 for an LCC firing room. Reconfiguration for supporting Saturn V and Saturn IB interchangeably was expected to take about 40 days for the LUT and negligible times for other facilities and equipment.

Four important question areas are suggested by the proposed shift of Saturn IB launches to LC-39. These are related to: 1) Some of the details of Boeing's proposed method for accommodating the S-IB stage in particular on the LUT, since it is here that the major modifications are required to achieve a Saturn IB capability on LC-39, and, of course, the veracity of their cost estimates, 2) the impact on manned space flight schedules of flying the five AAP missions from LC-39, 3) the feasibility of and best alternatives to sharing a single MSS between two vehicles for the AAP dual missions and 4) the subsequent use of LC-34 and LC-37.

The following sections are devoted to commentary on these questions.

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*An estimate of these additional costs indicates that they would fall in the range of $6-8 million for LC-34/37. Not all of these changes would have to be made at LC-39; for instance, the Converter-Compresser Facility at LC-39 already has the capacity to support dual Saturn IB launches and being farther from the launch pads, needs no special protection from the hazards of the launch environment.

S-IB RELATED MODIFICATIONS

From a list of the functions* of the LC-34 (and 37) S-IB forward swing arm, we may infer the functions that would have to be provided by the corresponding Swing Arm #5 in the recommended elevated pedestal configuration. The missing functions, those requiring new connections, are in the nature of control, sensing, or high pressure gas supply.

A nominal 68 inches also has to be added to the length of the swing arm to accommodate the smaller diameter of the S-IB. A grafted-on section of the LC-34 umbilicals could be used to provide this additional length and at the time correct any elevation mismatch.

The LC-37 pedestals both A&B could be used for the upper part of the proposed elevated platform on the LUT. They are constructed of steel about 1 1/2 inches thick and one 47 feet square as compared to a VAB high bay interior clear width, including doors, of 76 feet. The LC-37B pedestal is about 6 feet thick and include plumbing for deck, boat-tail and flame deflector deluge, RP-1 and LOX Tail Service Masts, two cable masts, and eight Support Holddown Arms, in short, all of the necessary pedestal interface functions. It also incorporates a self-storing engine service platform, camera mounting fixtures, railings and a liftoff transponder antenna. The LC-37A pedestal is structurally complete but has never been equipped. It could be equipped at least partially from LC-34 pedestal accessories for reconfiguring the second Saturn IB LUT. The LC-34 pedestal is constructed of reinforced concrete and would not lend itself to this kind of adaptation.

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*

LC-34/37	LC-39
S-IB Fwd Swing Arm	S-II Fwd Swing Arm (#5)
RP-1 Tank Helium Bottles Press.	LH_2 Tank Prepress.
RP-1 Tank Vent Control	LH_2 Tank Vent Lines (2)
RP-1 Tank Level Sensing	LH_2 Tank Vent Control
LO_2 Tank Vent Control	Air Cond. and Purge
Air Conditioning and Purge (Supply)	Insulation Purge
Air Conditioning and Purge (Return)	Auto Checkout (2)
Hazardous Gas Sensing (S-IVB aft inters)	Electrical (8)
Electrical	

The elevated pedestal would be tied into the LUT umbilical structure to stiffen it and avoid tolerance buildup between the tower and vehicle. This bracing would also minimize difficulties from increased cantilever loading of the LUT by new vehicle access arms should these become necessary.

Tail Service Mast functions for Saturn IB can be connected directly to corresponding functions available at the tower interfaces of the LUT Swing Arm No. 1 or at the deck interfaces of the three Saturn V Tail Service Masts.*

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*

The Saturn IB Tail Service Mast Interface Requirements are:	Corresponding functions are available on the Lut at:
Cable Mast No. 4	
LO_2 Repl. Valve Control	
LO_2 Tank F&D Valve Control	TSM 3-2
Control Bottle Pressure	TSM 3-4
LO_2 Tank Level Sensing (2)	
Eng. Press. Sw. c/o	
LO_2 Tank Bubbling - Helium	TSM 3-2
GG LO_2 Injection Manif. Purge	TSM 3-4
Air Cond. and Purge	TSM 3-2
Hazardous Gas Sensing LO_2 Bays	
Electrical	
Cable Mast No. 2	
RP-1 Tank F&D Valve Control	TSM 3-4
RP-1 & LO_2 Tank Prepress.	
LO_2 Tank Vent Control	
LO_2 Dome Purge (2)	
RP-1 Tank Bubbling	
TC Fuel Inj. Manifold Purge	TSM 3-2
Hazardous Gas Sensing (Eng. Comp.)	
Electrical	
Fuel Mast	
RP-1 Fill and Drain Line	TSM 1-2
LOX Mast	
LO_2 Tank Fill and Drain Line	SA #1
Replenish Conn.	
LO_2 Tank Replenish Line	SA #1

As with the swing arm, those functions not adaptacle from existing LUT services require physically small connections that can be added to the present LUTs without unduly complicating their convertability to Saturn V use.

Boeing's estimate of 190,000 pounds for the weight of the 127 foot high elevated pedestal assembly is well within the capability of the 250 ton high bay and 175 ton aisle cranes. High Bay #4 could also accommodate concurrent construction, storage, and handling of the elevated pedestals for two LUTs.

LAUNCH SCHEDULES

AAP (Saturn IB) launches are currently scheduled as shown in Figure 1, together with high and low launch rate projections for Saturn V. The figure also indicates major facility (High Bay, Pad) involvement and intervals for LUT refurbishment modification and/or reconfiguration between Saturn V and Saturn IB.

For the dates shown, Saturn V launches would be constrained to about one every four months from December 1970 until June 1972. Assuming a two month pad and MSS requirement for Saturn V, its missions would be denied launch during the ten months from July '71 to April '72. With an easing of the MSS requirement, some additional opportunity for Saturn V launch would become available between October and December.

Under the constraint of an Orbital Workshop lifetime in orbit of only eight months (a WACS propellant limitation), it is highly desirable to fly all of the AAP missions within the given 180 day schedule. A flexibility exists nonetheless to fly the final dual mission independently of the others. Two spare Saturn IB's, an OWS/AM/MDA, and a CSM are also available for AAP program flexibility.

REFURBISH AS A SCHEDULING FACTOR

The plan for refurbishing LUT 1 after AS-503 indicated a requirement of 48 days before follow-on launch operations could begin. Figure 1, in showing only 30 days, assumes a commensurate improvement in refurbishing efficiency.*

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*Refurbish time may actually be more a function of launch damage than of repair efficiency. Indications are that vehicle drift under the varying wind conditions of normal, i.e. successful, launches of Saturn V may result in repair requirements ranging from negligible to complete replacement of several swing arms and other tower appurtenances. Average refurbish time, then, is useful only on a gross planning level, but it is possible to speak in terms of system differences that affect the probabilities of damage.

Refurbishing time becomes a control factor in meeting the rapid-fire AAP manned launch schedules whether they are flown from LC-34 or LC-39. On LC-39, the preparation and launch of AAP-3A from the same LUT is planned 90 days, or about 66 working days, after the launch of AAP-1. Figure 2 illustrates this sequence of operations and that of the next 90 day follow-on launch of AAP-3, again from the same LUT.

Whether on LC-34 or on LC-39, this proximity of launches from the same platform will necessarily be difficult to accomplish. On LC-39, some additional time may also be required for the move from the VAB to the Pad, and as a result of the need to share the MSS between the concurrent operations of the dual missions.

On the other hand, launch-to-launch refurbishing needs may be less extensive on LC-39 than on LC-34. Saturn IB is expected (by Boeing) to impose much less launch damage to the LC-39 LUT or pad under the proposed modification concept than Saturn V or than the same Saturn IB would impose on LC-34 or LC-37. This is because its flame plume will be much farther away from the umbilical tower, swing arms, deck and flame deflector than in either of the other two cases. Boeing's proposal further provides for ablative coating protection on exposed trusswork of the elevated pedestal. The high capacity deluge system of LC-39 plumbed up the elevated pedestal should also be highly effective in minimizing damage.

LC-34 could be used in conjunction with LC-39 to ease the tight scheduling problem, but at a cost presumably near $15 million. Conversion of the third LC-39 LUT to resolve the tight schedule problem would cost $1.96 million (Boeing). It would also deny its use to the Saturn V program for the months May, June, November, and December of 1971. As we have seen, though, November and December would already be effectively denied by the Saturn V's need of the MSS for the entire two months it is on the pad.

In a reversal of the above logic, it is clear that the modification of one LC-39 LUT could provide an alternative to scheduling three rapid-fire launches in succession from LC-34 if the bulk of the AAP program were to remain on LC-34/37. Cost of this strategy is best expressed in Boeing's basic estimate of $2.5 million for one launch of one Saturn IB from LC-39.

In spite of the apprehension reflected in the above, Figure 2 and subsequent comments in this memorandum accept the assumption of AAP planning to date, that launcher refurbishing and preparation for the AAP-1 follow-on launches AAP-3A and AAP-3, can be accomplished in parallel.

MSS SHARING

Since a new Mobile Service Structure for LC-39 would cost, in itself ~\$20 million, the question of whether a single MSS can support the dual launches AAP-1/AAP-2 and AAP-3/AAP-4 is an important one. Boeing suggests that the unmanned vehicle in each pair, having no fuel cells, might be serviced early in the dual mission preparations. This way the MSS would be away from the manned vehicle only briefly. Then, it would return and stay with the manned vehicle until launch.

An alternative was also proposed. In this, all of the MSS functions for the unmanned missions would be performed from the LUT with MSS type access platforms and corollary services added to the existing umbilical tower. Only one LUT would have to be so modified.

The flow plan of Figure 2 assumes that the single MSS will be used to support all of the MSS functions of the dual missions. The figure thus serves to illustrate--though not to discover--some of the difficulties of MSS sharing.

Flow plans are based only on critical path items. It has therefore been almost impossible to positively identify all of the functions that the MSS has been used for by the several contractors of Apollo prime systems and so evaluate the potential effects of major changes in its use without a concerted and wide ranging study. As an example, it has been necessary in some countdowns to clean the stable platform viewing port (misting, etc.) in the IU for final platform alignment with the theodolite. Final alignment of this platform should take place about as late as possible to minimize azimuth drift error. Until now, the function has been possible only from the MSS.

The primary functions of the MSS are hypergol loading, cryogen loading, spacecraft helium servicing, ordnance hook-up, environmental protection and the accommodation of the special access needs of manual checkout and ACE "carry-on"* equipment. The MSS is generally required during Flight Readiness Testing. If there are fuel cells on board, it is also needed during Countdown Demonstration and Countdown to replenish cryogen boiloff. Apollo lunar missions also require the MSS in these periods to support LM supercritical helium servicing. MSS time considerations are also important, if less constraining, where hypergol vessels stress corrosion limitations may be exceeded by loading hypergols many days early, and where it is necessary to minimize personnel exposure to vessels pressurized beyond 50% of design burst. (For this reason, helium pressurization is typically delayed until launch day.) Furthermore, much of the ACE uplink capability is lost when the MSS is removed from the pad.

Following is a summary of the more critical fluid servicing and access requirements of AAP as they would be serviced on LC-39. Particular emphasis is placed on the MSS functions:

AAP-1, AAP-3A, AAP-3

These manned flights carry up to one-half the normal Apollo load of SPS propellants using sump tanks, only. In place of the supply tanks, they carry either five or seven supercritical cryogenic vessels. These will be serviced from MSS dewars containing LH_2, LOX, and LN_2. Cryogenic servicing will require several dewar-loads to complete. (Additional dewars will be required for AAP CSM servicing.)

SM/RCS propellant quantities will be about three times those of Apollo. Other fluid requirements, water-glycol coolant, CM/RCS propellants, helium, GN_2, GOX, and GH_2 will be serviced as in Apollo, all but the water-glycol coming from the MSS.

The launch vehicle propellants and loading requirements of Saturn IB differ from those of Saturn V mainly in being smaller and in there being one less stage. The S-IVB/APS, loaded from the MSS during spacecraft hypergol servicing is also smaller but otherwise similar, in terms of loading procedures, to the Saturn V version.

*So called because of early intent to carry the equipment into the CM during checkout. The equipment is now mounted on the MSS platform #4 and used from there.

AAP-2

The S-IVB/Orbital Workshop system uses a Workshop Attitude Control System (WACS) which is similar to S-IVB/APS except that its fluid requirements, MMH and N_2O_4, are about 50% greater. The Airlock Module and Multiple Docking Adapter are presently expected to carry no fluids at launch other than ECS coolants which can be charged from the LUT over the IU swing arm. If it is decided to service the EVA/GOX accumulator of the MDA before liftoff, this function can be provided from existing equipment on the LUT. Actuator supply gases such as those on docking probes, etc., will be charged before being placed onboard the spacecraft.

Access to the AM and MDA on the launch pad will be gained through the IU hatch by umbilical Swing Arm #7. Removable platforms, similar to those in the Apollo SLA will be used inside the new, expanded payload enclosure. The IU hatch and umbilical swing arm provide a path for their removal.

AAP-4

The S-IVB/APS units on AAP-4 are standard Saturn IB units. The LM/ATM carries no main-stage propulsion systems. The LM RCS will be loaded with about 30% more propellants than is standard for LM. Fuel for this system will be MMH in place of the usual Aerozine-50 which is not required for the unmanned missions, AAP-2 and AAP-4.

The AAP-4 LM also carries a GOX accumulator for EVA but it will probably not be serviced before launch. LM/ECS water glycol will be serviced from the umbilical tower.

The LM/ATM is mounted within a new, enlarged payload adapter and shroud. Penetrations for servicing lines (for hypergols) and access from the Service Structure can be tailored to the method of servicing whether from the MSS or from the LUT. It will also have internal platforms removable through the IU hatch and Umbilical Swing Arm #7.

Helium

Apollo Spacecraft and S-IVB/APS helium vessels are serviced on LC-39 from the MSS. A factor in timing this operation has been the minimizing of personnel exposure to vessels pressurized above 50% design burst. AAP-2 (WACS) and AAP-4 (S-IVB/APS and LM/RCS), if launched from LC-39, will not have the MSS available late in their pad processing schedules (T-2 or 3 days). There are three alternatives: 1) Waive the safety requirement minimum personnel exposure of the pressurization and service much earlier. (This is essentially ruled out by safety considerations and the need for access by large numbers of personnel.) 2) Use vessels with higher safety factors. (Long lead time, expense, payload penalty.)* 3) Service the helium vessels from the LUT. (Probable best solution.)

MSS FUNCTIONS FROM THE LUT

The Boeing plan for providing all MSS functions for the unmanned AAP missions from the LUT calls for three adjustable MSS-type platforms to be added to the LUT. Connecting lines for two hypergol servicers (S14-064, S14-057) and a helium servicer (S14-009) would also have to be added to the LUT. The two hypergol servicers are normally semi-permanently mounted on the MSS-22 foot level. Handled similarly on the LUT, they would constitute a launch hazard. A solution is needed for this problem.

A better, but still conservative, approach can be based on the assumption that MSS sharing is almost feasible for the AAP launch schedules.**

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*Current Mass Properties data indicates that both AAP-2 and AAP-4 have a 1000 to 1600 pound weight margin so that heavier helium vessels or perhaps manifolded helium lines for servicing from existing LUT swing arms may yet be a practicable solution.

**Indeed, the time (below) required to move the MSS from the LC-39 launch pad to the other seems to be about the most constraining factor.

Platform Breakup	4:00
Jack	:30
Travel (A to park site)	3:30
Travel (park site to B)	4:15
Jack	:30
Close Platforms	4:00
	16:45 hours

The MSS would be used only for loading hypergols on the unmanned vehicles.

MSS-type platforms on the LUT would be used for helium servicing, ordnance hookup and general access during FRT, CDDT, and countdown.

OTHER USES FOR LC-34 AND LC-37 BEYOND AAP

The investments in LC-34 and LC-37 reduced by their current almost negligible salvage value should be regarded as sunk cost. If the services they can still provide are available elsewhere at less total cost, that is, at less penalty in terms of money yet to be spent, interruption of other programs or loss of flexibility, then, there is where they should be purchased.

If LC-34/37 are expected to have a future need that is not serviceable at LC-39, then the possibility of avoiding standby maintenance and eventual refurbishment may not be available. This may be the situation indicated by recent mention, in a long range planning context, of using nine to twelve new Saturn IB's for a space station resupply vehicle. LC-34 or LC-37 or a single line at LC-39 can reasonably be expected to support successive near-duplicate launches of Saturn IB on a schedule of about one every 3-4 months. A launch rate in excess of this will require two lines. Other factors such as the expected concurrent Saturn V activity, the cost of a possible new LUT and the potentials for using LC-34 and one LC-39 LUT for Saturn IB have to be considered to get an optimized outcome.

There is also a question as to what launch systems may be required to support future launch vehicles. Among six concepts currently competing for attention as a new "national launch vehicle" in the 100,000 pound payload-to-low earth-orbit category is the 260" solid rocket boosted S-IVB (MLV SAT IB-5A). This vehicle is estimated to be cheaper (cost effectiveness or dollars/pound in orbit) than Saturn IB in a program of nine or more vehicles. But this figure is based on zero non-recurring costs for Saturn IB.* Only

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*Modified Saturn Launch Vehicles for AAP Earth Orbital Missions-Case 600-3, Memorandum for File, April 14, 1967, D. J. Belz.

the two Saturn IB's now listed as AAP spares have zero non-recurring costs. The cost of reactivating and updating the launch facilities after AAP ($30 million?) must now be added to this figure for a realistic comparison of the costs for a new buy of Saturn IB's.

Three separate studies* have all recommended either the use of the existing sites of LC-34 and LC-37 or moving major elements such as the umbilical tower, service structure, propellant facilities to a nearby site.

Launch facility studies for two other types of the competitive vehicle concepts, the clustered solid boosted S-IVB and the large pressure-fed liquid concepts have not been studied so thoroughly, but it is a reasonable assumption that these will make similar use of existing LC-34/37 sites or components.

Modification of LC-34/37 for a new vehicle with the AAP series transferred would, of course, require that the two complexes be maintained in their down mode at a cost that might be reduced to about half the presently expected $3 million annually.** The pedestal, firing accessories and similar elements that would be used to modify LC-39 for a Saturn IB capability would not be a loss to a new vehicle program as there would be among the first items discarded in converting LC-34/37 to any of the advanced vehicles mentioned above.

Of the new launch vehicle configurations, none but the INT-20 (S-IC/S-IVB) would be likely to be able to use the LC-39 mobile concept interchangeably with Saturns because of large configuration differences (pressure-fed liquids), better adaptability to LC-40/41 (Titan derivatives) or great weight (the solid boosted vehicles).

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*By Martin, Bellcomm, and Douglas.

**It would take 13 months (Bellcomm) to 18 months (Douglas) from start of construction until LC-34 or 37 could be readied for a new launch vehicle. The time required for two R&D flights and the preparation of a first man-rated vehicle would likely result in a total delay following a Saturn IB launched from LC-34/37 to about 27 months.

SUMMARY AND CONCLUSIONS

A comparison of interface requirements of the S-IB stage and the services presently available on the LC-39 LUTs indicates that the LUT can, indeed, be adapted at a moderate cost and with reasonable convertibility to Saturn IB use by the elevated pedestal concept outlined by Boeing. LC-34 and LC-37 firing accessories are available and can be used to minimize the cost of adapting LC-39. The VAB lends itself easily to the construction, storage, and handling of the components and to reconfiguring the LUT between Saturn V and Saturn IB in about 40 days.

The five flight missions of AAP can be accommodated on LC-39 without notable disruption of the MSF Level 1 Schedule. The one exception is that the last Saturn V flight on the high launch rate version of that schedule would have to be slipped about one month.

Flying the five AAPs from LC-39 on their nominal schedule would deny use of pad facilities for Saturn V for about eight months; the launch-to-launch interval for Saturn V over this period would be ten months. Outside of this interval, Saturn V launches would be constrained to one every four months for another eight months.

Refurbish of the Saturn IB LUT that is used for the three manned AAP launches could present a problem in meeting of the rapid-fire schedule for these launches. However, there is little reason to believe that the situation would be worse than it would be on LC-34; it may be better if launch damage is a major factor, since LC-39 is less vulnerable than LC-34 or 37 to Saturn IB damage.

Predictably, the biggest question relates to the fact that LC-39 has only one Service Structure while LC-34 and 37 have two. Analysis of the AAP flow plan seems to indicate that any plan for simply sharing the MSS would have a doubtful feasibility. Several altreations to established procedure in both the sequence and timing of operations would be required. Servicing gaseous helium would probably be the most critical of these operations on the unmanned missions.

Boeing's proposal for adding adjustable MSS-type platforms to one of the LUTs avoids the need for sharing the MSS. However, it adds the considerable difficulties and expense of having to accommodate hypergol servicing equipment and plumbing on a LUT.

A more desirable but still adequately cautious alternative to the Boeing suggestion is to share the MSS hypergol servicing functions but use new LUT access platforms for all other MSS functions.

If LC-34 and 37 are abandoned by AAP, their subsequent cost of maintenance is chargeable to any identifiable follow-on program that may use them. The EOSS may use them with Saturn IB's, but in the numbers of vehicles implied new, much modified, vehicles may be preferable to Saturn IB. Elements scavenged from LC-34/37 to build a Saturn IB capability at LC-39 would be among the first discarded in modifying LC-34/37 for such follow-on vehicles. Only one, the most expensive of the outlined concepts for 100K lb payload follow-on vehicles would be likely to use the LC-39 mobile concept. The others because of their great weight or special configurations would be more likely to use LC-34, 37, or LC-40/41.

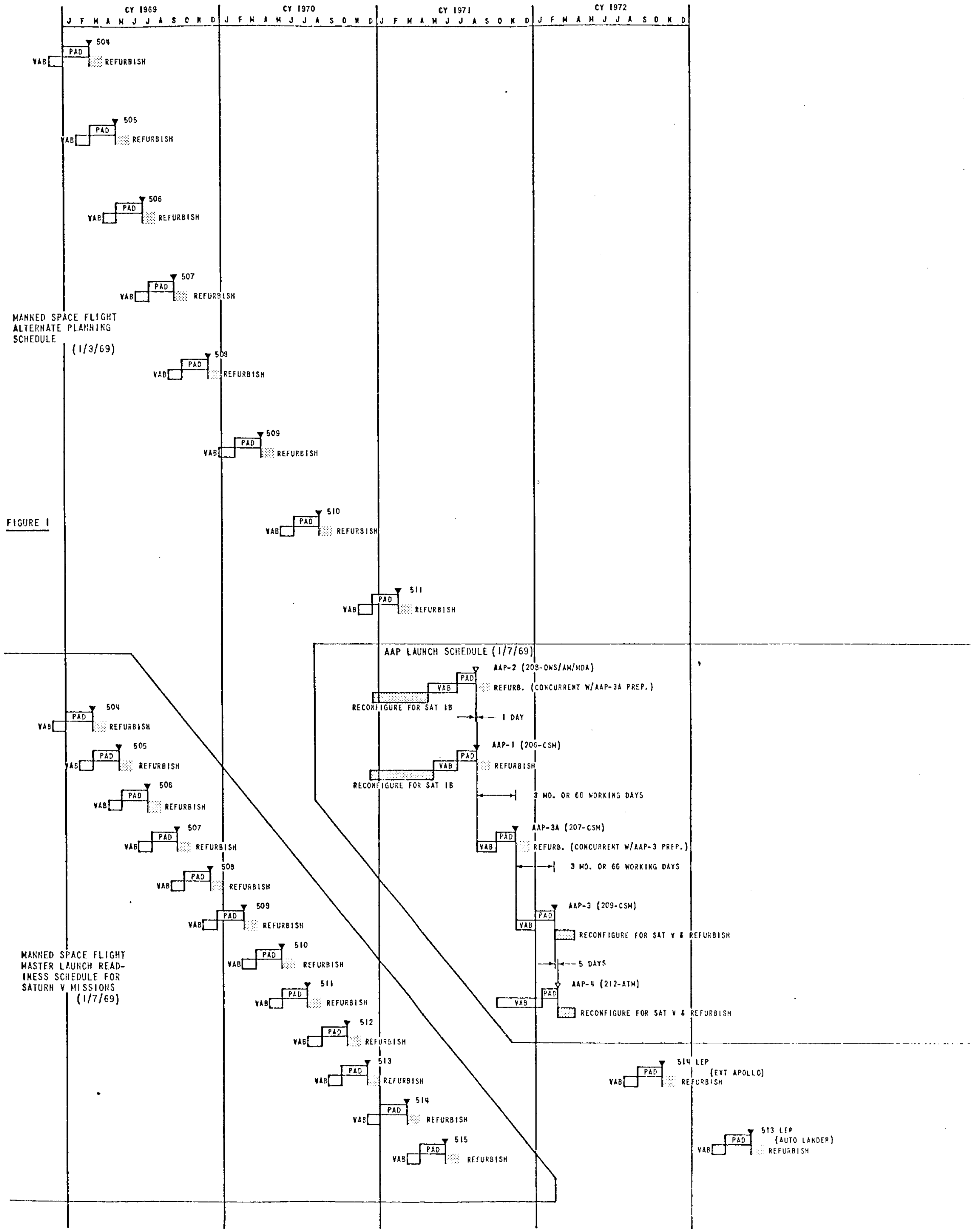
KSC STUDIES

KSC in-house studies seem to be leading them to conclusions on launching Saturn IB/AAP from LC-39 similar to or at least consistent with those outlined above. It is also anticipated that their review of the costs will result in essential agreement with Boeing's $9.5 million.

G. W. Craft

2032-GWC-mp

Attachments
Figures 1 and 2



CY 1969
CY 1970
CY 1971
CY 1972
J F M A M J J A S O N D
MANNED SPACE FLIGHT ALTERNATE PLANNING SCHEDULE (1/3/69)
504
505
506
507
508
509
510
511
512
513
514
515
VAB
PAD
REFURBISH
AAP LAUNCH SCHEDULE (1/7/69)
AAP-2 (208-OWS/AM/MDA)
REFURB. (CONCURRENT W/AAP-3A PREP.)
RECONFIGURE FOR SAT IB
1 DAY
AAP-1 (206-CSM)
3 MO. OR 66 WORKING DAYS
AAP-3A (207-CSM)
REFURB. (CONCURRENT W/AAP-3 PREP.)
AAP-3 (209-CSM)
RECONFIGURE FOR SAT V & REFURBISH
5 DAYS
AAP-4 (212-ATM)
MANNED SPACE FLIGHT MASTER LAUNCH READINESS SCHEDULE FOR SATURN V MISSIONS (1/7/69)
514 LEP (EXT APOLLO)
513 LEP (AUTO LANDER)

FIGURE 1

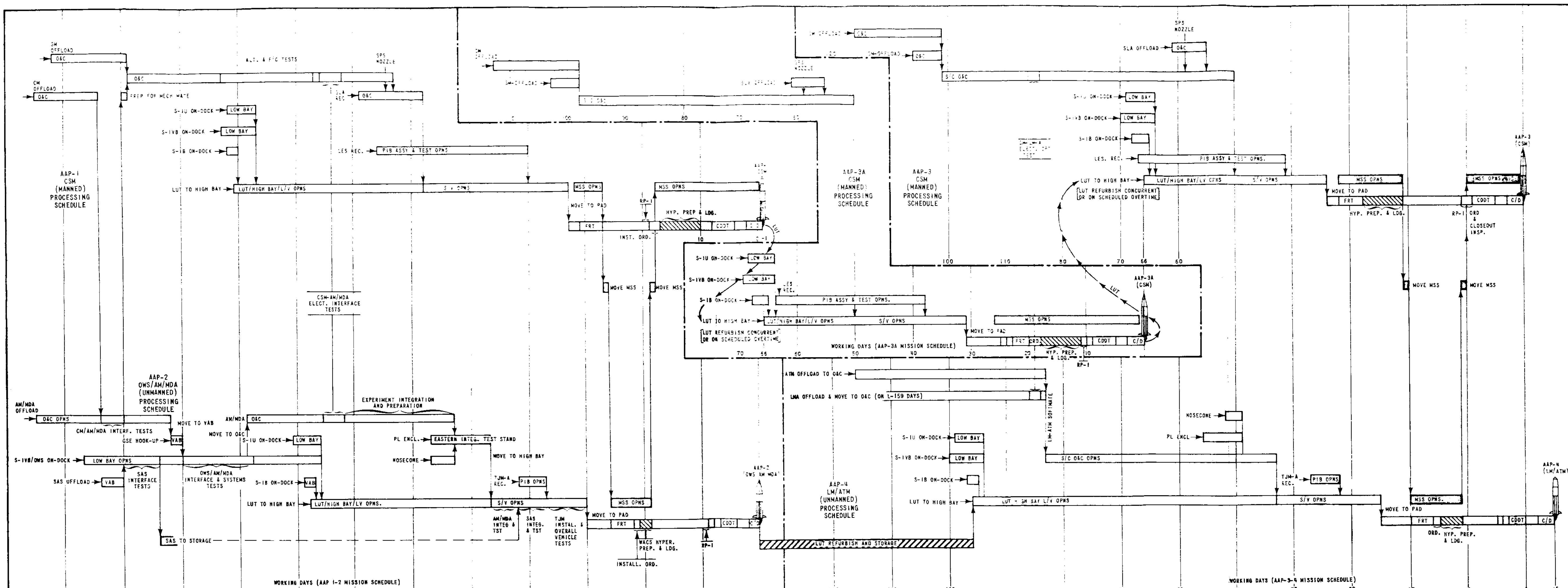


FIGURE 2 - FLOW PLAN STUDY FOR AAP LAUNCH FROM LC-39 INSTEAD OF LC-34/37
G.W. CRAFT MARCH 3, 1969 REF. = KSC AAP VEHICLES FLOW PLAN NOV. 21, 1968

BELLCOMM, INC.

Subject: Commentary - Use of LC-39 for the Launching of Saturn IB's in the Apollo Applications Program
Case 620

From: G. W. Craft

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